SECTION 16660
SPECIAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes;

1. Radio Antenna Tower

a. Radio Antennas

2. Electrical requirements for communications and computer requirements.

3. Telecommunications wiring requirements

4. Public address system requirements

B. The extent of work indicated by drawings and schedules, but is not limited to conduit, outlet boxes, backboards, data voice communication system and computer raceway and cable.

1.02 SUBMITTALS

A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data, shop drawings and layout and manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 Conduit, fittings, boxes, wire per Section 16050, Basic Materials and Methods.

2.02 RADIO ANTENNA TOWER AND RADIO ANTENNAS

Monopole Antenna Tower

Furnish and install a 40' steel self-supporting monopole communications antenna tower with horizontal cross-arm. Suggested manufacturer: Sabre Communications Corp., 2101 Murray Street, P.O. Box 658, Sioux City, ID 51102-0658; Tel. 1-800-369-6690; Fax 1-712-279-0814. All materials shall be galvanized iron, u.o.n.

The Contractor shall furnish all materials and labor that is necessary to accomplish a complete tower, antenna and coaxial cable installation, including tower, antenna and coaxial grounding.

Coaxial Cable Entrance into Building

A covered horizontal cable support bridge shall be furnished and installed to support coaxial cable when it exits the portal on the monopole tower and extends to the building. A wireless Solutions EP-1650 cable entry port shall be installed on the side of the building for coaxial cable entry. Parts and accessories for proper waterproofing and grounding shall be furnished and installed in accordance with the manufacturer's published specifications.

UHF Two-Way Radio Antenna Installation

Furnish and install two Celwave PD-201 UHF fiberglass two-way radio antennas (488 MHz) and 7/8" rigid coaxial cable. One of the antennas shall be mounted on top of the tower and one shall be mounted on a horizontal-cross arm at the 30' level. Refer to the attached drawing.

The Contractor shall be required to furnish and install 7/8" rigid coaxial cable connectors, hardware to attach the antennas and cable to the tower, grounding kits, brackets and miscellaneous hardware that is necessary for a full and complete installation. The coaxial cable shall be securely terminated inside Room 204 within six cable-feet of the radio equipment racks. UHF T-Band Polyphaser lightening protection devices with female "N" connectors shall be furnished and installed for each antenna in the radio equipment room.

The coaxial cable may be Andrew, Times or Cableware brand, 50 ohm impedance, less that 0.85dB attenuation per 100 feet at 450 MHz.

VHF Two-Way Radio Antenna Installation

Furnish and install one Celwave BA-1012 VHF fiberglass two-way radio antenna (154 MHz) and ½" rigid coaxial cable on the new tower. This antennas shall be mounted on a horizontal crossarm that is to be mounted approximately 10' below the top of the tower. A minimum of 6' horizontal separation shall be maintained between antennas at this level.

The Contractor shall supply ½" rigid coaxial cable, coaxial cable connectors, hardware to attach the antennas and cable to the tower, grounding kits, crossarm, brackets, and miscellaneous hardware that is necessary for a full and complete installation. The coaxial cable shall be securely terminated inside Room 204 within six cable-feet of the radio equipment racks. A VHF (514 MHz) Polyphaser lightening protection device shall be furnished and installed for these antennas.

The coaxial cable may be Andrew, Times or Cablewave brand, 50 ohm impedance, less than 0.9 dB attenuation per 100 feet at 150 MHz.

Antenna Installation Craftsmanship Requirements

Quality installation craftsmanship is essential for this project. All towers, antennas, coaxial cable, brackets and other hardware shall be installed in accordance with the manufacturer's published installation specifications. Proper grounding and weatherproofing is essential.

Coaxial cable shall be attached to the tower in accordance with the cable manufacturer's recommended procedure using the recommended products. A sufficient quantity of cable hangar brackets shall be furnished and installed to meet the manufacturer's recommendation and to assure a durable, long-lasting installation.

Each two-way antenna and coaxial cable shall be tested for proper operation after installation is complete using a Wiltron S331 Site Master, or equivalent. Plots showing acceptable test results must be furnished to the Town prior to project acceptance.

In the absence of a detailed manufacturer's installation specification, the general specifications contained the Motorola R56 Quality Standards for Fixed Network Equipment Installation shall apply. (Motorola publication number 68-81089E50-0 dated 01/31/94.)

2.03 ELECTRICAL REQUIREMENTS FOR COMMUNICATIONS AND COMPUTER EQUIPMENT

Electrical Receptacle Requirements for Rooms 111 and 204

Two 120VA UPS circuits are required in Room 111. An orange 4-plex receptacle shall be installed near each dispatch workstation. In addition to these two UPS circuits, two 20A non-UPS circuits are also required in Room 111. A standard color 4-plex receptacle shall be installed near each dispatch workstation. Each 4-plex receptacle shall have its own dedicated circuit breaker. These UPS and non-UPS circuits are in addition to the normal office receptacles that are currently shown on the drawings.

A minimum of four 120V 20A UPS circuits are required for Room 204. An orange 4-plex receptacle shall be installed near the top of each aluminum equipment rack. Refer to the attached sketch for approximate locations.

A minimum of seven on-UPS receptacle are required for Room 204. The receptacles may be surface-mounted with exposed conduit. Refer to the attached sketch for approximate locations.

All Ups and non-UPS receptacles described above shall be marked with a permanently attached durable label that indicated the corresponding sub-panel and circuit breaker number.

Uninterruptible Power System (UPS)

A battery-backup uninterruptible power system be included in the electrical requirements for the new Police Station. The equipment shall be a Best Power FE7, or engineer approved equal. The UPS shall be capable of supplying 117VAC at 7 kVA on battery power for at least 10 minutes.

The purpose of the UPS is to 1) protect critical computer and communications equipment from voltage spikes, sags and transients; and 2) to provide uninterrupted operation of the equipment between the time a commercial power failure occurs and when the building generator starts.

An external "make before break" bypass switch is required for maintenance purposes. This is a standard option for the Best Power FE7.

For the exact location for the UPS see drawings.

A sub-panel for the UPS protected load shall be located directly outside of Room 204. The UPS receptacles are required only in Rooms 111 and 204. All Ups receptacles shall be orange.

2.04 SCOPE OF WORK

1. OVERVIEW

A. MAIN TELECOMMUNICATIONS ROOM

Owner provided WAN/LAN data networking equipment and other ancillary systems will be installed in Room 204.

Room 204 will be the main distribution point for voice and data station cable to all Colma PD locations. Cable will run through conduit and accessible ceiling areas from Room 204 to all voice and data station locations. Flush mount wall outlet boxes with conduit stubbed into ceilings is required at all station locations. Above ceiling cable support systems must be provided per EIA/TIA 569 standards (i.e., 4' to 5' intervals).

B. CABLING SYSTEMS

Enhanced Margin Category 5 data intra-building station cable will be used to support voice grade services and data networks throughout the new facility.

For The typical station outlet, Contractor shall provide and install (terminate, label and test) two (2) Enhanced Margin Category 5 (voice) and 2 Enhanced Margin Category 5 4-pair (data) unshielded twisted pair cables (UTP) per EIA/TIA 568A and 569 building standards. Category 5 voice cables shall be terminated on 66 style wiring blocks within Room 204 and on Category 3-rated RJ-11 modular jacks at the station end. The 66 blocks shall be mounted on blue color wooden backboards using 89B mounting hardware. Category 5e data cable shall be terminated on Category 5e patch panels within Room 204 and on Category 5e rated RJ-45 modular jacks at the station end (cable length must not exceed 90 meters). Voice and data cables shall be terminated at the station end in a single gang, multi-outlet flush mount box (faceplate color to be determined). Type or computer-generated labels shall be required for Room 204 termination hardware as well as station faceplates using a labeling scheme approved by the Town.
For voice-only stations, Contractor shall provide and install (place, terminate, label and test) one Category 5e 4-pair cable from Room 204 termination wiring block to designated station locations. These station cables will support "voice only" (e.g., wall phone, pay phones, etc.) station locations.

C. LABELING

Contractor shall provide and install labeling as herein specified for all cable and hardware including faceplates.

D. TESTING

The Contractor shall be responsible for providing all necessary test equipment to certify all new installed cable systems. This test equipment must include, but not limited to: Category 5e testers with two-way injectors.

E. WARRANTEES

The complete cable infrastructure system, including all equipment, parts, materials and labor, under normal used and service, shall be free from defects and faulty workmanship for a minimum of **one (1) year** from the date of total System Acceptance ("Warranty Period").

The system shall function in accordance with all requirements of this specification, and current specifications and descriptions published or disseminated by the component manufacturer(s).

F. STANDARDS FOR MATERIALS AND SERVICES

All equipment and materials shall be new. **All equipment and materials shall be the latest version available of all hardware, and shall conform to the highest current applicable telecommunications industry standards**. Defective

or damaged equipment and materials shall be replaced or repaired, prior to System Cutover, in a manner that meets the approval of the Town and at no additional cost to the Town.

During the Warranty Period (after System Acceptance) and during subsequent maintenance period, Contractor may provide replacement of defective equipment/components with new or refurbished equipment/components. Such replacement equipment/components shall be of equal or greater performance characteristics, engineering/design levels, and appearance than replaced equipment/components.

2. SYSTEM SPECIFICATIONS

A. GENERAL REQUIREMENTS

The selected Contractor shall furnish all supervision, labor, materials and equipment needed to complete all work specified in this specification. This work shall include all Contractor-provided resources necessary to provide required new voice and data cable systems in accordance with the specifications provided herein. Additionally, the Contractor must provide all necessary tools, equipment and materials (e.g., cable runways, cable management hardware, screws, anchors, clamps, tie-wraps, distribution rings, pull ropes, miscellaneous hardware, etc.), needed to facilitate the installation of required systems.

All labor and materials shall be provided and equipment used in compliance with the current laws and regulations of State, County and Town Fire Marshals, Building Industry Consulting Service International (BICSI), the National Electric Code (NEC), the Uniform Building Code (UBC), communication standards published by EIA/TIA, and all other applicable codes and standards.

It is the Contractor's responsibility to survey all existing inter- and intra-building raceway systems and cable paths to determine their lengths and adequacy to support proposed cabling systems, and to develop the methodology required for installation of all inter-and intra-building voice and data cable.

All intra-building voice and cable must be properly rated for individual building conditions. Plenum-rated cable must be utilized where required by the NEC and the local Fire Marshal. All station cable will be 4-pair Category 5 for voice and data.

The Contractor shall insure that manufacturer-recommended maximum pulling tensions and minimum bending radius of the cables being installed are not exceeded at any time during installation. Failure to follow such guidelines will result in the Contractor providing additional material and labor necessary to rectify any problems resulting from such situations, at no additional cost of the

Town. This shall also apply to any and all damages to the cables caused by the Contractor during implementation.

All voice and data station shall be installed and terminated in Room 204 on wiring blocks and patch panels. **Cables shall be terminated and labeled in proper sequence, left to right**. Failure to maintain ascending number sequence will result in Contractor having to re-terminate cable, which may include replacement of cable if it is too short to properly dress onto termination hardware.

All installed intra-building cable must be properly labeled, tested and documented. This documentation, which is due at project completion, shall include one set of bound test results and computer-readable copies (including viewing software) and one set of red-lined as-built drawings.

All cable installations shall be done in compliance with applicable and current BICSI methods, Bell System Practices, and EIA/TIA Standards.

B. CABLE SUPPORT SYSTEM

All cables not installed in conduit/raceways shall be supported by Contractor-provided, industry standard hardware. This supporting hardware (e.g., allthread, J-hooks, bridle rings, ceiling support wires, Caddy clips, etc.) must comply with EIA/TIA 569 standards for support at **4' to 5'** intervals.

C. CEILING AND WALL PENETRATION HARDWARE

Contractor shall be responsible for determining location, quantity and sizing of EMT ceiling and wall penetration conduit or sleeves that will be required to transition contractor-provided intra-building cable from Room 204 to above ceiling areas and out to each station location. These penetrations shall include, but not limited to, 4" EMT conduit anchored to building structure using allthread, unistrut and strut clamps and shall have connectors and plastic bushings at both ends of each sleeve. Ceiling surface material shall be neatly trimmed to fit snugly around penetration sleeves.

D. MISCELLANEOUS

Contractor shall be responsible for providing all equipment and hardware necessary to provide adequate cable management on backboards and equipment racks, and all miscellaneous anchoring, mounting hardware and tywraps.

3. STATION CABLE AND HARDWARE

For the typical station outlet, Contractor shall provide and install (terminate, label and test) two (2) Enhanced Margin Category 5 (voice) and 2 Enhanced Margin Category 5 4-

pair (data) unshielded twisted pair cables (UTP) per EIA/TIA 568A and 569 building standards. Category 5 voice cables shall be terminated on 66 style writing blocks within Room 204 and on Category 3-rated RJ-11 modular jacks at the station end. Category 5 data cable shall be terminated on Category 5 patch panels within Room 204 and on Category 5 rated RJ-45 modular jacks at the station end (cable length must not exceed 90 meters). Voice and data cables should be terminated at the station end in a single gang, multi-outlet flush mount box (faceplate color to be determined). Typed or computer-generated labels are required for Room 204 termination hardware as well as station faceplates.

For voice only stations, Contractor shall provide and install (place, terminate, label and test) one Category 5 4-pair cable from Room 204 to designated station locations. These station cables will support "voice only" (e.g., wall phone, pay phones, etc.) station locations.

A. STATION CABLE

All Contractor-provided voice station cables shall be Enhanced Margin Category 5 Lucent, Belden or equivalent PVC or plenum 4-pair unshielded twisted pair (UTP) copper cable. All Contractor-provided data station cable shall be Category 5 Enhanced Margin (350 MHz) Lucent, Belden or equivalent 4-pair unshielded twisted pair (UTP) copper cable. Fire resistant rated cables are required in any plenum-rated building areas.

Installation of cable must meet all specifications identified in the applicable EIA/TIA Commercial Building Wiring Standards. Care must be taken to avoid excessive bending radii and to **not over pull, microbend, kink, or overbind** cable during installation.

Care is required in the management of the station cable as it enters Room 204. All cables must be neatly organized, routed and secured with tie-wraps to the cable support systems and management hardware in an aesthetically pleasing manner. Cable must have the appearance of being combed, with no tangles. Cable overlap must be kept to a minimum. Improperly installed cable may be required to be redressed or possibly replaced at the Contractor's expense.

A minimum of 6" to 12" cable slack shall be provided at each workstation termination. Care must be taken to maintain minimum bending radii and to avoid kinking when dressing excess cable at termination locations.

Category 5 termination methods for Category 5 station cable must be followed for termination Room 204 patch panels and at station jacks. **Specific care must be taken to maintain pair twists up to point of termination, or no less than ½" of termination.**

Ceiling tiles may be in place at the start of this installation. Contractor will be required to remove, safely store, and replace ceiling tiles daily or as required. Scratched or damaged ceiling grid system and/or soiled damaged acoustical tiles shall be replaced with equivalent ceiling system materials at Contractor's expense.

B. ROOM 204 TERMINATION HARDWARE

Contractor shall provide and install 66-Type wiring blocks for termination of all voice station cables. Wiring blocks quantities must provide for 25% growth.

Contractor shall provide and install Lucent or equivalent data patch panels and patch cord organizers (within Room 204). Patch cord organizers are required with each panel. Patch panels shall be installed in quantities adequate to support 25% growth.

C. STATION TERMINATION HARDWARE

Contractor shall provide and install Lucent or equivalent Category 3 and 5 termination hardware.

For the typical station location, voice and data cables should be terminated at the station end in a single gang, multi-outlet flush mount box (faceplate color to be determined). Each combined voice and data faceplate will contain two (2) Category 3 RJ-11 jacks terminated to two Category 5e 4-pair cables for voice, and two (2) Category 5e RJ-45 (568A) jacks terminated on two Category 5e 4-pair cables for data. Voice and data jacks shall be installed in duplex configuration (voice in the top A position, and data in the bottom B position) sharing a common faceplate.

For a voice only station location, voice faceplate or modular blocks (ivory) will contain one (1) RJ-11 jack terminated to one Category 5 4-pair cable. AT & T or equivalent wall phone faceplates shall be stainless steel with mating lugs for wall phone mounting.

D. CATEGORY 5e PATCH CORDS

Contractor shall not required to provide patch cords.

E. LABELING

All patch panels and faceplates shall be labeled with typed or computer-generated labels. Cables shall be labeled using an indelible ink pen.

Temporary type markings are not acceptable on the patch panels or workstation faceplates. Contractor shall be responsible for removing markings or replacing

trim, housing, and other items where such markings cannot be readily removed. Required cable records will accurately reflect the installed labeling format. Provide labels as follows:

F. PATCH PANELS AND FACEPLATES

Contractor shall furnish and install adhesive backed labels for each patch panels port and each faceplate port. Labels shall be typewritten or computer generated indicating room.workstation number (numeric), faceplate position (alpha), and jack position (alpha).

Example of label: 537-A-A

G. WIRING BLOCKS

Contractor shall label the wiring block designation strips with room/workstation number, faceplate position, and jack position.

Example of label: 312-B-A

H. VOICE AND DATA STATION CABLE

Contractor shall label each cable at both ends. Labels will be consecutively numbered with telecommunication closet, room/workstation number, faceplate and jack position.

Example of label: MTC 119-A-A

4. CABLE TESTING

This Section describes performance tests required for acceptance of newly installed cables. Tests shall be conducted in accordance with EIA/TIA Standards. All provide and installed cables are to be tested.

A. ACCEPTANCE TESTING FOR VOICE AND DATA STATION CABLE

Test shall be conducted in accordance with EIA/TIA Standards. Contractor shall test all installed and terminated voice and data cables. Cables test are to be conducted to ensure that the engineering design is achieved in the actual construction and that transmission quality meets specifications and objectives described herein. These tests are design to detect damage or errors that may have occurred in the placing or termination of the cable.

1. Voice Cable Testing

Contractor shall test all installed and terminated voice cable using modular-type test equipment. Voice cable shall be tested in a manner that will identify the following fault conditions:

- Opens
- Shorts
- Grounds
- Split pairs
- Polarity reversals
- Transposed pairs

Contractor shall submit test result documentation indicating "pass" condition with notations indicating any required repairs. Test result documentation shall be dated and signed by test technician and shall be neatly bound.

2. Data Category 5e Cable Testing

Contractor shall test all installed and terminated Category 5 voice and data cable. Category 5 4-pair cable shall be tested with full sweep frequency measurements from 1 Mhz to 100 Mhz for EIA/TIA CATEGORY 5 channel performance measurement. **Complete 4-pair testing is required in one direction for the following characteristics.**

Near-end-cross talk (NEXT)	Mapping
Attenuation-to-Crosstalk Ratio (ACR)	Length
Resistance	Impedance
Attenuation	Capacitance

Complete 4-pair testing is required in the opposite direction for:

Near-End-Crosstalk (NEXT)
Attenuation-to-Crosstalk Radio (ACR)

Use of test equipment with a two-way injector that measures NEXT and ACR simultaneously from both cable ends of the link will preclude the requirement for bi-directional testing.

All Category 5 cable must be tested using a Category 5 Level II field tester.

B. DOCUMENTATION OF TEST RESULTS

Hard and soft (computer readable) copies of all test results shall be provided as documentation and will become part of the "as-built" record. Windows based viewing software must be provided with the computer readable copies if the

documents are not in standard text file or RTF format. One set of all test results shall be neatly bound, including soft copy disks, and provided prior to cable systems acceptance and project completion.

5. INSTALLATION DRAWINGS ("AS BUILTS")

An integral part of this proposed infrastructure and cable project will be the development of detailed as-built drawings.

A. AS-BUILTS

As-built drawings shall include accurately "red-lined" plans detailing all installed station cable and network schematics. The as-built drawings shall indicate detailed inter-building fiber and copper counts, termination locations, and voice and data station locations.

B. CABLE RECORDS

Cable records shall include complete and accurate accounting for all station cable pairs. Installed label format must be reflected in all cable records.

C. DOCUMENTATION

Test result, cable records and as-built drawings shall be provided as documentation and will become part of the "as-built" record. One neatly bound copy of test results and cable records, and one set of completed "reproducible" as-built drawings shall be submitted to the Town Project Manager prior to cable systems acceptance and project completion.

6. SYSTEM ACCEPTANCE

The term *"Acceptance"* be defined as the Town's notice to Contractor that the voice and data cable systems are completed and successfully tested, punch list corrections have been made to the Town's satisfaction, and all required documentation has been received.

Within a thirty (30) calendar day period after the Contractor has notified the Town that the have met all Cable Systems Acceptance criteria as previously stated (*"Acceptance Period"*), the Town shall notify Contractor in writing of its Acceptance of these systems or specifying in reasonable detail those particulars which the Town deems unacceptable. The systems shall not be Accepted until all such material particulars are corrected.

At the end of the thirty-calendar-day Acceptance Period or upon the successful completion of any cure period extending the Acceptance Period, the Town shall promptly notify Contractor of Acceptance of the systems in writing.

7. WARRANTY AND SERVICE

A. WARRANTY PERIOD

Contractor shall provide Warranty on all materials and work proposed in response to this specification, including all parts and labor, for a period of one (1) year from the date of System Acceptance by the Town.

1. Labor and Materials

During the Warranty Period, Contractor agrees at its expense and its option to either repair or replace any defective cable related component provided initially or post-cutover by Contractor and any added during the Warranty Period. Contractor shall provide such repair services and replacement parts as are necessary to keep the cable system operating in accordance with the Town's specifications. All replacement parts and materials shall be of at least equal performance and quality to the original.

Contractor must warrant that all complete systems, including all equipment, parts, materials and labor referenced in any Agreement resulting from this specification shall, under normal use and service, be free from defects and faulty workmanship for a minimum of one (1) year from the date of total System Acceptance ("Warranty Period").

2.05 PUBLIC ADDRESS SYSTEM

A. GENERAL

All public-address speakers shall be eight-inch ceiling speakers with integrated internal two-channel amplifiers. They shall be mounted in manufacturer-approved backboxes. No centralized amplifier(s) shall be used.

One of each speaker shall be designated as the "A" input and will be used for overhead paging via the telephone system. Each speaker shall have an externally accessible integrated volume control on this channel.

The other input of each speaker shall be designated as the "B" input and will be used for distributing police audio to selected areas of the building. Each speaker shall have an internal volume control for this channel. Some rooms require wall-mounted volume controls. These volume controls shall affect only the "B" input of the speaker.

B. PRODUCTS AND MATERIALS

Quantities are approximate. Refer to drawings for quantity and location.

Qty.	Item
TBD	Valcom Model V-1220 amplified dual input speakers
TBD	Valcom Model V-9916 backbox with 24" bridge
TBD	Valcom Model 1092 wall-mount volume control
TBD	Valcom Model V-2003A three zone paging controller
TBD	Valcom Model VP-2024 power supply
TBD	Wood backboards w/ 89B punch-block mounts
TBD	Siemens S66M-1 Type-66 punch block
TBD	4 pair 24 AWG unrated unshielded twisted-pair telephone wire

Valcom, Inc.
1111 Industry Avenue
Roanoke, VA 24013-3900
Ph: (540)427-3900
Fax: (540)427-3517

C. INSTALLATION CRAFTSMANSHIP

Installation craftsmanship shall be consistent with modern telecommunication industry standards. Wiring distribution shall be done on standard Type-66 punch-down blocks.

Wiring must be configured so that paging zones can easily be redefined by simply moving cross-connect wiring. It shall not be necessary to re-terminate speaker station cable to rearrange paging zones.

All speaker cables shall be terminated in Room 204 on colored wood backboards mounted on a plywood backboard. The Owner's telecommunications engineering firm shall designate the exact location of the punch blocks and backboard at the time of installation. Contractor shall coordinate the installation of equipment in this room with Telecommunication Engineering Associates, Phone: (650) 590-1801.

At least three separate power supplies shall be used. Speakers shall be staggered so that no single area of the building is served by a single power supply.

All cable runs shall be free from shorts, open and physical damage.

Standard 4-pair, 24 AWG, unshielded twisted pair cable shall be used to connect each speaker to a common distribution point. **No more than three (3) speakers shall "daisy-chained" on a single run of 4-pair cable.** The white/blue cable pair shall be used for audio channel "A" and the white/orange pair for audio channel "B". The white/green and white/brown pairs shall be used in parallel for

24vcd power (tip to tip and ring to ring). Telecommunications industry-standard color codes shall be used.

D. AS-BUILT DOCUMENTATION

Contractor shall prepare as-built drawings showing the location and wire routing of each speaker and volume control.

Each speaker shall be internally labeled with a unique number that corresponds to a specific cable and location on the punch-blocks in the equipment room.

E. TESTING AND LEVEL SETTING REQUIREMENTS

The Owner's telecommunications consultant will inspect the system to verify proper operation, compliance with specifications, and accuracy of as-built documentation. The Owner will not accept the public-address system until this inspection is successfully completed.

A walk-through inspection will be conducted with the Contractor's representative, Owner's staff, the Architect and the Owner's telecommunications engineer to inspect the system and to advise the Contractor on final level setting requirements. The Contractor shall set levels on each speaker during the walk through inspection.

All speakers shall be free from hum, noise and audio rectification interference. This will be tested by terminating the "A" and "B" input channels of the speakers in Room 204 with 1000 ohm resistors and listening to each speaker with the respective volume controls set to maximum. Perceptible noise, hum, or the presence of foreign audio is not acceptable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Besides specific installation requirements noted in 2.02 thru 2.05 above contract shall coordinate with other trades.

END OF SECTION